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Final Report

**Boreal Forest Watch
A BOREAS Outreach Program**

NAG5-3978
30 June 1999

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Background

The Boreal Forest Watch program was initiated in the fall of 1994 to act as an educational outreach program for the BOREAS project in both the BOREAS Southern Study Area (SSA) and Northern Study Area (NSA). Boreal Forest Watch (BFW) was designed to introduce area high school teachers and their students to the types of research activities occurring as part of the BOREAS study of Canadian boreal forests. Several teacher training workshops were offered to teachers from central and northern Saskatchewan and northern Manitoba between May, 1995 and February, 1999; teachers were introduced to techniques for involving their students in on-going environmental monitoring studies within local forested stands.

Boreal Forest Watch is an educational outreach program which brings high school students and research scientists together to study the forest and foster a sustainable relationship between people and the planetary life-support system we depend upon. Personnel from the University of New Hampshire (UNH), Complex Systems Research Center (CSRC), with the cooperation from the Prince Albert National Park (PANP), instituted this program to help teachers within the BOREAS Study Areas offer real science research experience to their students. The program has the potential to complement large research projects, such as BOREAS, by providing useful student-collected data to scientists. Yet, the primary goal of BFW is to allow teachers and students to experience a hands-on, inquiry-based approach to learning science—emulating the process followed by research scientists.

In addition to introducing these teachers to on-going BOREAS research, the other goals of the BFW program were to:

- 1) to introduce authentic science topics and methods to students and teachers through hands-on, field-based activities; and,
- 2) to build a database of student-collected environmental monitoring data for future global change studies in the boreal region.

Teachers and students set up permanent sampling plots in a forested setting near their school or at the Prince Albert National Park and made a variety of measurements and observations following standard protocols. In this manner students learn the process of science, and use authentic science collection methods and equipment to collect and analyze data. During presentations, in written materials and at training sessions, the concepts of climate change, carbon cycling and the importance of the boreal biome in terrestrial and atmospheric processes were highlighted. Additionally, teachers were trained in the use of state-of-the-art remote sensing data, Landsat TM specifically, and provided with MultiSpec image processing software and local subset

images for their school's town. Several additional activities were provided and a variety of resource materials were made available.

The Boreal Forest Watch program was integrated with the Saskatchewan curriculum and is an extension of the material found in the province's primary environmental resource booklet: *Focus On Forests: Saskatchewan*. Boreal Forest Watch teaching resources have been correlated with the Saskatchewan Science Curriculum, *Focus On Forests: Saskatchewan*, Saskatchewan's Science Scope and Sequence: Dimensions & Factors, and with the Canadian Common Essential Learning (CELs) standards.

Completed Activities In Support of This Grant

The primary emphasis of this program was to provide a focused and interactive outreach component to the BOREAS research activities. This was completed by offering in-service training sessions to teachers who could then disseminate information about BOREAS research activities and environmental and climate change research to a larger audience. Several types of materials were developed in support of in-service trainings and other outreach activities (see 2. below). Currently the program is still functioning and is being actively administered at the Prince Albert National Park, Waskesiu, Saskatchewan, Canada. Specific components developed under this grant are described below.

1. Training Sessions & Workshops

As of March, 1999 a total of nine training sessions and workshops had been conducted with more than 90 participants attending. Table 1 describes the date, location and number of participants for training sessions and follow-on workshops which have been held as of the end of March, 1999. Over 35 schools have been directly involved in BFW to date.

Participants at in-service workshops learned about the BOREAS research activities and how to implement the Boreal Forest Watch program in their classroom. They received materials listed under 2.) below and practiced hands-on field and laboratory research protocols. Several follow-on workshops were also conducted with previously trained teachers in order to assess the progress and to present new material. These activities were suggested, in part, by participating BOREAS researchers.

Examples of science protocols teachers were introduced to include:

- Site selection & plot layout
- Sample tree identification
- Qualitative & phenologic observations
- Site & tree picture record
- Tree diameter, height & canopy height
- Tree form & diagnosis
- Tree cores & age
- Overstory & understory characterization
- Fresh sample collections
- Needle anatomical investigations
- Landcover mapping using Landsat data
- Remote sensing & image processing
- BOREAS educational CD-ROM
- Basal area determination
- Chlorophyll determination

Table 1: Boreal Forest Watch Training Sessions & Workshops

Date of Workshop	Purpose	Number Present
March, 1995	Organizational Meeting with several school administrators, teachers and Prince Albert National Park representatives	~ 8 attendees
May, 1995	Initial Boreal Forest Watch in-service training session for high school teachers, held at the PANP, Waskesiu, SK (BOREAS SSA).	10 Teachers 2 Park Representatives
September 4-8, 1996	BFW in-service training session for high school teachers, held at the PANP (BOREAS SSA)	10 Teachers 2 Park Representatives 2 Organizational Reps
May 2-3, 1997	BFW in-service training session for middle and high school teachers, held at the Heritage North Museum, Thompson, MB (BOREAS NSA)	13 Teachers 2 Museum Representatives 1 Provincial Forester
May 12-13	BFW Follow-on & in-service introduction & training mini-workshop for teachers and administrators held at the Prince Albert Model Forest Association (PAMFA), Prince Albert, SK (BOREAS SSA)	~ 8 participants comprised of teachers, PANP reps, and other organizational reps
May 14-15, 1998	Follow-on workshop and module training held at the Heritage North Museum, Thompson, MB (BOREAS NSA)	13 Teachers 1 Museum Rep.
October 14-15, 1998	In-service training session for new teachers from the Northern Lights District, SK held in Prince Albert, SK (BOREAS SSA)	18 Teachers
February 22, 1999	In-service mini-workshop held for new teachers at Martensville High School, near Saskatoon, SK (BOREAS SSA)	6 Teachers

2. Materials Developed & Distributed

Several materials were developed under this grant for support of in-service training and general outreach information of BOREAS and BFW. These materials were designed to meet curriculum standards in Canada, be flexible to future adaptation and have a long usability life—they were intended to be relevant long after the completion of the BOREAS field effort in Canada.

- Teacher's Manual with over 300 pages of introductory information, information on the BOREAS project, scientific protocols & data sheets, and auxiliary information.
- An introductory video on the Boreal Forest Watch program (6 minutes).
- A video on proper methods for conducting protocols (50 minutes).
- 3 videos on remote sensing/environmental monitoring (each ~15-20 min.).
- A scripted slide set discussing the importance of environmental monitoring and the BOREAS research effort (42 slides).
- A 4-color poster of Prince Albert As Seen From Space displaying a modified Landsat TM Scene for the BOREAS SSA (22" x 36").
- Small format 4-color posters describing image processing (8.5" x 11").
- A Teacher's Kit.
- Shared equipment packages w/ \$1000 worth of research grade equipment for conducting research protocols.
- A package of research articles produced from the BOREAS research efforts.
- A BFW Web site.
- MultiSpec image processing software distribution.
- Landsat TM image 512 x 512 pixel subsets for each school's geographical area.
- Various educational resources provided during training sessions & follow-on workshops (books, diagnostic keys, photographs, etc.).

3. Other Outreach Activities

In addition to the workshops and in-service training sessions which were conducted to introduce teachers to the Boreal Forest Watch program, several other outreach efforts were conducted in association with the program. Several papers were presented at professional science conferences and educational conferences as well as the publication of a peer-review paper on Boreal Forest Watch in the educational literature. To assist in the implementation of the program in the classroom, the Boreal Forest Watch program materials were presented to the Saskatchewan Board of Education for official review and approval for use in meeting Saskatchewan curriculum standards.

A. *Papers/presentations were made at the following conferences:*

- i) Spencer, S.L. and B.N. Rock. 1996. Boreal Forest Watch: an educational outreach program: experiential learning through participation in a real data-collection effort. *In proc. of Eco-Informa '96 Conference*. 4-7- November 1996, Orlando, Fl. 10:509-514.

A poster presentation was also made at this conference under the same title.

- ii) Spencer, S., Huczek, G. and Muir, B. 1998. Developing a student-scientist partnership: Boreal Forest Watch. *J. Sci. Ed. and Tech.* 7(1):31-43.
- iii) Spencer, S. and Rock, B. 1997. *Poster Presentation*: Boreal Forest Watch: an educational outreach program. ASPRS Annual Convention. 7-10 April 1997, Seattle, Washington.
- iv) Huczek, G. 1998. *Presentation*: Boreal Forest Watch. Saskatchewan Science Teachers Society. Spring, 1998.
- v) Spencer, S., Huczek, G. and Muir, B. 1998. Boreal Forest Watch: a BOREAS outreach program. *Saskatchewan Accelerator*. June, 1998 24(3):10
- vi) Spencer, S., Huczek, G. and Muir, B. 1998. Developing a students-scientist partnership: Boreal Forest Watch. Part 1. *Saskatchewan Accelerator*. November, 1998, 25(1):9-16.
- vii) Spencer, S., Huczek, G. and Muir, B. 1999. Developing a students-scientist partnership: Boreal Forest Watch. Part 2. *Saskatchewan Accelerator*. Winter, 1999, 25(2):.

In addition, several newspaper articles were published in the Thompson, MB, Prince Albert, SK and Saskatoon, SK areas about the Boreal Forest Watch program.

A live television interview with B. Rock (UNH) and B. Muir (PANP) was broadcast on the BBS Saskatchewan network from their Prince Albert studios on August 16, 1996 regarding the Boreal Forest Watch program, the BOREAS project and satellite remote sensing.

Several presentations were conducted at the University of New Hampshire in the Departments of Natural Resources and Complex Systems Research Center as well as to several undergraduate and graduate level courses on both the BFW program and the BOREAS project.

The program has also been published on the Canadian SchoolNet Internet site, a resource used by K-12 teachers and students in Canada.

B. Outreach to visitors at the Prince Albert National Park

- i) Several short articles were published about both the BFW program and the BOREAS project through PANP bulletins.
- ii) An informational display and kiosk was established at the PANP visitors center regarding the efforts of the Boreal Forest Watch program.
- iii) Select visitors participated in park tours which include stops at permanent field study sites established for the BFW program. Several groups participated actively in by conducting BFW protocols at field sites (this is an on-going activity).

C. Discussions with potential collaborators for implementing the Boreal Forest Watch program were held.

In May, 1998 several government and non-government organizations met, in individual meetings, with staff from the University of New Hampshire and the Prince Albert National Park

to discuss possibilities for expanding the Boreal Forest Watch program to make it available to a wider audience. These talks were held between May 10 and May 15 at various locations in Saskatchewan and Manitoba. The organizations included:

May 11th: Canadian Space Science Resource Center, Saskatoon, SK

May 12th: Prince Albert Model Forest Association, Prince Albert, SK

May 13th: Prince Albert Satellite Ground Station, Prince Albert, SK

May 14th: Heritage North Museum, Thompson, MB

May 15th: Native Elders of the Cree Nation, Thompson, MB

4. Future Directions

NASA support of the Boreal Forest Watch program ended in January, 1999. The Prince Albert National Park has assumed administrative and training operations of the Boreal Forest Watch program. Staff members at the PANP continue to offer training, follow-on workshops and site visits to local schools involved with the BFW program. Schools from northern Saskatchewan, north of the BOREAS SSA, have recently joined the program and hope to acquire access to Landsat TM data for their field sites. The University of New Hampshire will continue to offer technical and scientific expertise to program administrators at the PANP.

Telephone discussions were held with Dr. Josef Cihlar, Mr. Peter Paul and Mr. Bill Bruce from the Canadian Center for Remote Sensing about the potential for implementing BFW across all provinces of Canada. At present these discussions continue, with the intention of providing the Canadian government with the opportunity of expanding the BFW program as appropriate. Discussions included the potential for access to additional Landsat TM scenes for areas outside the BOREAS study sites and the possibility for integrating Radarsat data into the current BFW framework.

Summary

The Boreal Forest Watch program was developed to assist in outreach of the BOREAS research activities for the areas in and around the Northern Study Area and Southern Study Area. Boreal Forest Watch has been successful at recruiting Canadian teachers in Saskatchewan and Manitoba to become involved with a hands-on outreach program which introduces them and their students to environmental monitoring science, similar to the ground-based studies of BOREAS. Well over 90 teachers have been directly introduced to both BFW and BOREAS with many more students, organizations, and PANP visitors informed about the types of research NASA has been conducting in their region. The written materials and videos produced under this grant highlight the importance of the BOREAS research and the need to understand how the boreal biome interacts with changes in the global environment.

Return-Path: <ghuczek@sk.sympatico.ca>
Date: Fri, 16 Oct 1998 16:28:53 -0600
From: George Huczek <ghuczek@sk.sympatico.ca>
Subject: Re: BFW Fall Workshop
X-Sender: ghuczek@mailhost.sk.sympatico.ca
To: Shannon Spencer <shannon.spencer@unh.edu>
Content-Length: 627

Hi Shannon,

Our workshop has just finished. We had 17 participants altogether, though a few could not stay for the entire two days.

The feedback that Brad and I received during and after the workshop indicated that it was a success. The participants, who were hand-picked to attend, were very enthusiastic about the possibilities that BFW will offer then in their classrooms.

Brad will be sending you the workshop evaluation forms. He and I both took photographs during our field trip. As soon as I have developed and printed mine I will send them to you for possible inclusion in the BFW web site.

Regards,
George